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Toxfin™: The additional benefits of using clays in animal feeds

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Toxfin™ Dry is a blend of activated/ modified clays, bentonite and sepiolite. Bentonite is also known as dioctahedral montmorillonite/ smectite and sepiolite is also known as meerschaum or hydrated sodium silicate, to name a few of the alternative names used for these compounds.

The activation process is important, as most clays in their pure and unprocessed form have fairly limited binding ability to mycotoxins and generally bind mostly Aflatoxins. Clays and activated clays may possess a variety of different effects, depending on composition, structure, binding capacity, charge distribution and number, to name a few. With processing and structural changes to the molecular configuration, it is possible to enhance the spectrum and affinity of binding, to more selectively bind mycotoxins or give other enhanced functions. Kemin has developed a trusted, effective and safe mycotoxin binder, which has proven itself for over 2 decades in the industry. Different clays exist and even each mining location can provide a different structure and activity, thus effects and benefits may vary between products. A summary of research and some findings for various forms of clays is summarised below.

Added Advantages of Clays in Feed Manufacturing

Clays are frequently added to feeds as binding and lubricating agents in the production of pelleted feeds for chickens and other animal species. The clays showing the highest efficacy on pelleting quality are bentonites and sodium bentonites.

Research at Kansas State University (Pfost & Young, 1973) showed that the addition of 2% bentonite clay to a medium-grind maize-soya pellet could reduce fines from 11.7% to 7.8%. An additional study by Moradi *et al*. tested 1% sodium bentonite inclusion in broiler rations and showed improved PDI values, from 88.60% to 90.50% (1.90% increase in PDI) in starter rations at 1% sodium bentonite inclusion and from 76.10% to 86.40% (10.3% increase) in finisher rations at 1% inclusion of sodium bentonite.

Added Advantages of Clays in Livestock

Overall:

Clays may have beneficial effects on digestion and help to decrease the speed/ rate of passage of feed within the digestive tract. This has been shown in multiple cases to enhance feed utilisation and FCR, due to improved nutrient utilisation from enhanced digestion and absorption (Almquist *et al*, 1967; Quisenberry and Bradley, 1964; Kurnick and Reid 1960). These effects have been demonstrated across multiple species, including poultry, pigs and dairy cows. Nutrient digestibility and enzymatic activity of gastrointestinal secretions has also been seen to be improved through the addition of clays in feeds. It is also suggested from studies by Song *et al* (2012), that clays may be able to lyse bacterial cells through tearing of the cell membrane and also bind some of the bacterial toxins. Additionally, clays may assist barrier function of the intestinal tract, through adhesion to the intestinal membrane, creating a re-enforced barrier function and reduced bacterial complications. (Song *et al*, 2012)

Layers/ Broilers (Poultry):
Bentonites have a high-swelling and water absorbing capacity, which make them attractive dietary additives for reducing wet droppings in caged layer birds. In addition, experiments show that layers fed diets containing clays exhibit significant increases in body weight, egg size and life expectancy, even at a lower caloric intake than the control group. Some of these effects may be mirrored in other species as well, due to the functional effects exerted by clays. (Sellers *et al*, 1980)

Swine:
Studies in pigs have shown that feeding clays can increase nutrient absorption, notably of Calcium, Phosphorus and Nitrogen components, as well as decreasing the incidence, duration and severity of diarrhoea. The mode of action has not been clearly defined, though some theories have been proposed based on research results and data, such as increased villi length within the intestinal tract, increased number of Goblet cells, increased activity of pancreatic enzymes (formation of complexes between the clay and enzymes, resulting in better pH range of action), morphological changes within the digestive tract and decreased passage rate. Most studies tend to show a greater effect in younger piglets (creep, weaner and grower phases) than in older pigs (finisher phases). Research also indicates changes in bacterial populations, with increases in *Bifidobacteria* and *Lactobacillus* and decreases in *Clostridia* and *E. coli* in the small intestine of pigs fed clays. The numbers of pigs born alive and weaned, birth weight and weaning weight have also been shown to be higher in sows fed clays. Additional studies have also shown a decrease in mastitis, pyrexia (fever) and poor appetite in sows fed diets containing clays. (Subramanium & Kim, 2015)

Ruminants/ Dairy Cows:
Feeding clays to dairy cows has been shown to help alleviate the effects of grain challenges (acidosis) on the rumen environment and have even been shown to improve dairy cow performance. Cows fed various concentrations of clay tended to yield more milk and produced more 3.5% Fat Corrected Milk (FCM) and Energy Corrected Milk (ECM). A positive linear treatment effect on rumen pH shows that clays can aid in buffering the rumen pH and also reduce the amount of time that the rumen pH is below pH 5.6. Studies indicate that clays could be used as buffers, due to the positive effects on physiological and production parameters (Sulzberger *et al*, 2016).

Added Advantages of Clays in Reducing Waste & Emissions

Clays have been shown to decrease ammonia production (decreased faecal ammonia), as well as reducing the levels of faecal volatile fatty acids excreted, such as acetic, propionic and butyric acids.
Studies have also indicated that feeding clays can cause a shift in nitrogen excretion, as demonstrated in 2 studies in pigs, where a higher faecal ammonia excretion was seen, with a lower urinary nitrogen. As urinary nitrogen is more volatile than faecal nitrogen, the change in excretion pattern may reduce the amount of nitrogen lost to the environment. (Poulsen *et al*, 1995; Shurson *et al*, 1984).

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